Computational Science and Engineering

Final Exam in
Computer Architecture and Networks

Winter Term 2013/2014
February 12, 2014

Total score: 90 points

Time: 90 minutes

Instructions:

Write all answers onto these sheets – no other answers will be considered! You will get additional scratch paper to work out your solutions, however, this will not be collected and not be considered!

Answers can be given in English or German.

This exam is a **closed book** exam – i. e. no books, notes, or similar aids and also no electronic calculators of any kind are permitted!

Please do not use red or green pens.

In case you need to leave the room, you need to deposit your test sheet. Only one person is allowed to leave the room at one time.

There will be an announcement 10 minutes before the end of the test time.

After the test, please remain seated until all tests have been collected and counted.

Name: _____

Matr. Number: _____

Signature: _____

Question 1, Flip Flop (10 points):

Explain the concept of an RS Flip Flop and what it is mainly being used for (draw a logical circuit).

Which types of memory do you know, and which one is using Flip Flops?

Question 2, Data Formats (15 points):

What are the basic data formats being used in an x86-64 architecture, and how many bytes are required for them?

Starting with MMX, how were the basic data formats later extended?

Question 3, Memory / Caches (15 points):

Draw a typical memory hierarchy of a computing system, depicting different access speed and capacity!

Which replacement strategy is used for a direct mapped cache? Explain why!

Question 5, Execution Models and Addressing Schemes (20 points):

Which execution models for processor architectures do you know? What are the advantages and disadvantages of each execution model?

Which addressing schemes for memory addressing do you know? Which of these schemes is useful for array indexing?

Question 5, Predication (20 points):

How can conditional branches in an `if-then-else` construct be avoided using predication?

C-Code   Non-Predicated assembly code: Predicated assembly code:

```
if (a<b)
  c++;
else
  d--;
```

Does this also work for nested `if-then-else` constructs?

C-Code   Non-Predicated assembly code: Predicated assembly code:

```
if (a<b)
  c++;
else {
  d--;
  if (e!=f)
    g+=2;
}
```

Question 6: Networks (10 points):

Outline the ISO/OSI seven layer model being used as a generic model for computer networks:

What are the differences to the TCP/IP protocol suite, if any?